**Topic 4 - Genetics – Study Guide**

**4.1 Chromosomes, genes, alleles and mutations**

Do you know what eukaryote chromosomes are made of?

Can you define gene, allele, genome, and gene mutation?

Can you explain the consequence of a base substitution mutation in relation to the process of transcription and translation, using the example of sickle-cell anemia?

**4.2 Meiosis**

Can you describe the purpose of meiosis?

Can you define homologous chromosomes?

Can you outline the process of meiosis? (include main events)

Can you explain the consequences of non-disjunction during meiosis? (use Down syndrome as reference)

Do you know what karyotyping is and how it is performed?

Can you analyze a human karyotype to determine gender and possible problems?

**4.3 Theoretical genetics**

Can you define genotype, phenotype, dominant allele, recessive allele, codominant alleles, locus, homozygous, heterozygous, carrier and test cross?

Can you determine the genotypes and phenotypes of the offspring of a monohybrid cross using a Punnet grid?

Do you know what multiple alleles are?

Can you describe ABO blood groups as an example of codominance and multiple alleles?

Do you know how sex chromosomes control gender? Do you know the differences between the X and Y chromosomes?

Can you define sex linkage?

Can you describe the inheritance of color blindness and hemophilia as examples of sex linkage?

Can you predict the genotypic and phenotypic ratios of offspring of monohybrid crosses involving any of the above patterns of inheritance?

Do you know how to deduce the genotypes and phenotypes of individuals in pedigree charts?

**4.4. Genetic engineering and biotechnology**

Can you outline the use of polymerase chain reaction (PCR)?

Do you know what happens with DNA during electrophoresis? Do you know what this is used for?

Can you describe the application of DNA profiling?

Can you analyze DNA profiles to draw conclusions about paternity or forensic investigations?

Can you outline three outcomes of the sequencing of the complete human genome?

Do you know what happens when genes are transferred between species?

Can you outline a basic technique used for gene transfer involving plasmids, a host cell (bacterium, yeast or other cell), restriction enzymes (endonucleases) and DNA ligase?

Can you state two examples of the current uses of genetically modified crops or animals?

Can you discuss the potential benefits and possible harmful effects of one example of genetic modification?

Can you define clone?

Can you outline a technique for cloning using differentiated animal cells?

Can you discuss the ethical issues of therapeutic cloning in humans?